PVD DEPOSITION PROCESS FOR ENHANCED PROPERTIES OF METAL FILMS

Michael Rumer, Jack Griswold, Tom Dorsh, Michael Ng, David E. Reedy, Paul D. Healey, Michal Danek, and Reed W. Rosenberg

ABSTRACT OF THE DISCLOSURE

A physical vapor deposition sputtering process for enhancing the <0002> preferred orientation of a titanium layer uses hydrogen before or during the deposition process. Using the oriented titanium layer as a base layer for a titanium, titanium nitride, aluminum interconnect stack results in formation of an aluminum layer with predominant <111> crystallographic orientation which provides enhanced resistance to electromigration. In one process, a mixture of an inert gas, usually argon, and hydrogen is used as the sputtering gas for PVD deposition of titanium in place of pure argon. Alternatively, titanium is deposited in a two-step process in which an initial burst of hydrogen is introduced into the reaction chamber in a separate, first step. Pure argon is used as the sputtering gas for the titanium deposition in a second step. The method is broadly applicable to the deposition of metallization layers.